

REMARKS/ARGUMENTS

Status of the Claims

1. The Applicants hereby thank the Examiner for the observations in the Final Office Action mailed January 31, 2007. Applicant has herein amended Claims 22, 24, 25 and 27 to place the claims in better form for consideration. No new matter has been added by these amendments. Claims 1-27 are pending. Non-elected invention Claims 1-20 have been withdrawn.

Claim Objections

2. Claims 23 and 24 have been objected to under 37 CFR 1.75 (c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant respectfully traverses this rejection.

The Examiner presents an argument regarding the device in independent Claim 22, from which Claim 23 and 24 depend from, having a hard mask only existing in Figs. 2, 3 and 4A. He then cites that in Figs. 4B and 5, the hard mask has been removed so that the tapered sidewall is formed. He concludes from this logic that since Claim 23 and 24 recite: "via includes a tapered sidewall" that there is no more hard mask, therefore Claims 23 and 24 fail to further limit Claim 22 or contradict Claim 22.

The way the argument is presented, Applicants believe that the Examiner is not comprehending the steps involved in the process to create the claimed device. The hard mask is etched away when the third fluoride gas is released into the chamber. The third fluoride gas etches the hard mask away, and it is in the polymer layer which already has a defined sub-micron wide via-opening, that further etching occurs at the polymer layer proximal to the sub-micron wide via-opening, thereby, creating a tapered sidewall.

Claims 23 and 24 further limit the subject matter of the previous claim by further limiting the length of the tapered sidewall to a specific range of greater than or equal to one third the depth of the via (Claim 23) or less than or equal to one half the depth of the via (Claim 24). This does not apply to the hard mask layer, but to the polymer layer, therefore

there is no logical reasoning behind the Examiners objection regarding the hard mask being removed such that Claims 23 and 24 fail to further limit Claim 22 or are contradicting to Claim 22. Applicant respectfully requests that this objection be withdrawn as Claims 23 and 24 clearly further limit the subject matter of the previous claim.

Claim Rejections - 35 U.S.C. 112

3. Claims 21-27 have been rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The Examiner argues that there does not appear to be a written description of the claim limitation “the via hole comprises an aspect ratio which is greater than 1, and is of substantially the same diameter throughout the depth of the via hole” (Claims 21, 22 and 25). Applicants respectfully traverse this rejection.

The Examiner supports his argument with cites to the specification, page 8, [0032], regarding the tapered sidewall. It is clearly obvious to one skilled in the art that when Applicant refers to a tapered sidewall, they are not referring to the depth of the via that is substantially the same diameter. There is a clear distinction set out in the specification at p. 6, [0026], as well as Figs. 2B and 2C, that releasing a first fluoride gas into the chamber, etches a hard mask opening for defining a via hole, and then a second fluoride gas is released into the chamber to etch an exposed portion of the polymer layer defining said via hole with a vertical sidewall. This via hole has substantially the same diameter throughout the depth of the via hole. Applicants would like to bring to the Examiners attention that when the third fluoride gas is released creating the tapered sidewall, the tapered portion of the via hole is distinctly different from that portion of the via hole having substantially the same diameter. No new matter has been added by the descriptive words “substantially the same diameter throughout the depth of the via hole” as it is clearly defined in the specification as the result of releasing the second fluoride gas into the chamber. Therefore, Applicants respectfully request that this rejection be withdrawn.

4. The Examiner has rejected Claims 22-24 under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements. The

Examiner cites the omitted structural cooperative relationship to be: the **via hole** and the polymer layer or the hard mask or the semiconductor substrate. Applicants respectfully traverse this rejection.

Applicants believe that the Examiner has failed to recognize that in this claim, the semiconductor substrate placed in the chamber already includes a polymer layer defining a sub-micron wide via-opening deposited on said polymer layer. Therefore, when the third fluoride gas is released in the chamber, it etches the hard mask and an exposed portion of the polymer layer proximal to the sub-micron wide via-opening, thereby creating the tapered sidewall within the via hole. Applicant has herein amended Claim 22 to delete “hole” as it appears to have caused some confusion to the Examiner. It was simply to further clarify that the depth of the via was being referred to at that step. Therefore, the Applicants believe that there are no omitted structural cooperative relationships and respectfully request that this rejection be withdrawn.

5. The Examiner has rejected Claims 22-24 under 35 U.S.C. 112, second paragraph, as being indefinite for lacking antecedent basis in the limitation “whereby the via hole comprises.....”. Applicant has herein amended Claim 22 to delete “hole” as it was simply there to clarify any confusion regarding what dimension of the via was being referred to. Via standing alone, clearly has antecedent basis. Therefore, the Applicants respectfully request that this rejection be withdrawn.

6. Claims 23, 24 and 27 have been rejected under 35 U.S.C. 112, second paragraph for failing to particularly point out and distinctly claim the subject matter. Applicants respectfully traverse this rejection.

As pointed out above in paragraph 2 of the arguments herein, the Examiner has again confused what is occurring at each step of the process. The third fluoride gas etches away the hard mask and also etches the polymer layer proximal to the via-opening, thereby creating a tapered sidewall. The Applicant is unable to understand where the Examiner believes that a hard-mask is still being referred to in Claims 23 and 24. The tapered sidewall in the polymer layer is what Claims 23 and 24 refer to. Therefore, the Examiners argument that Claims 23

and 24 claim the element of the hard mask which no longer exists is wrong. Claims 23 and 24 do not claim the hard mask. Therefore, Applicants respectfully request that this rejection be withdrawn.

With respect to Claims 24 and 27 , Applicant has herein amended the claims to reflect that the upper limit of one-half is the correct measurement. The Applicants would like to thank the Examiner for pointing out this error. Therefore, Claims 24 and 27 are not indefinite. Applicant respectfully requests that this ground of rejection be withdrawn.

7. The Examiner is mistaken in his suggestion that the claims are a translation into English from a foreign document. However, the Applicant has considered the Examiners comments and has made amendments to the Claims believed to further distinctly claim the apparatus such that all the features of the claimed device are fully accounted for as suggested by the Examiner.

Claim Rejections - 35 U.S.C. 102

8. Claim 25 has been rejected under 35 U.S.C. 102(b) as being anticipated by Lin '369. Applicants respectfully traverse this rejection. The Examiner has idealized the drawings in Lin to conform to what he believes the invention to be in Lin. Nowhere within Lin '369 does it teach the elements of Claim 25. Lin '369 Figures 9 and 10 which are cited by the Examiner do not even show the elements as claimed in the present invention. Therefore, the Applicants respectfully request that this rejection be withdrawn, and Claim 25 be passed to allowance.

Claim Rejections - 35 U.S.C. 103

9. Claim 21 has been rejected, under 35 U.S.C. §103(a) as being unpatentable over Yu et al (U.S. Patent No. 6,004,883) in view of Lin (U.S. Pub. No. 2002/0068441). The Applicants hereby continue and maintain their traversal of this rejection and respectfully request reconsideration of this ground of rejection in light of the remarks submitted in the Response to Office Action dated November 20, 2006 Section III. Applicants respectfully

request that this ground for rejection on this basis be withdrawn and that Claim 21 be passed to allowance.

10. Claims 22-24 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Yu '883 in view of Lin (U.S. Pat No. 6,515,369). The Applicants respectfully traverse this rejection and respectfully request reconsideration of this ground of rejection in light of the following remarks.

Addressing the cited art and as conceded by the Examiner, Yu merely teaches a typical prior art method for fabricating a dual damascene patterned conductor. Nowhere does Yu disclose forming a via nor a via hole comprising an aspect ratio which is greater than 1, and is of substantially the same diameter throughout at least one-half the depth of the via. Yu's method would not result in the claimed via nor the corresponding claimed via structure.

Since Yu does not render the present invention obvious for the reasons stated above, adding Lin '369 merely for the aspect ratio, and the vertical sidewall would still not teach or accomplish the structure of the claimed device.

Further, Applicants traverse that the novel process that results in the claimed structure would involve a mere change in the size of a component, and that such change is generally recognized as being within the level of ordinary skill in the art. The Examiner has failed to cite any art which can support this argument of being generally recognized within the level of ordinary skill in the art at the time the invention was filed.

Therefore, the Applicants respectfully request that this ground of rejection on this basis be withdrawn and that Claim 22 be passed to allowance.

With respect to Claims 23 and 24, Applicants respectfully submit the above arguments since Claim 23 and 24 depend from Claim 22.

In regards to the Examiner stating that there is no disclosure of either the *critical nature of the claimed extending of the tapered sidewall in the range from one-third to one half* or any unexpected results arising therefrom, the Applicants respectfully traverse this argument presented by the Examiner. Support can be found at [0032] and [0035] of the specification.

Therefore, the Applicants respectfully request that the rejection be withdrawn and the Claims be passed to allowance.

11. Claims 26 and 27 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Lin '369. The Applicants respectfully traverse this ground of rejection. The Examiner has idealized the drawings in Lin to conform to what he believes the invention to be in Lin. Nowhere within Lin '369 does it teach the elements of Claims 26 and 27. Lin '369 Figures 9 and 10 which are cited by the Examiner do not even show the elements as claimed in the present invention.

In regards to the Examiner stating that there is no disclosure of either the *critical nature of the claimed extending of the tapered sidewall in the range from one-third to one half* or any unexpected results arising therefrom, the Applicants respectfully traverse this argument presented by the Examiner. Support can be found at [0032] and [0035] of the specification.

Therefore, the Applicants respectfully request that the rejection be withdrawn and the Claims be passed to allowance.

Response to Arguments

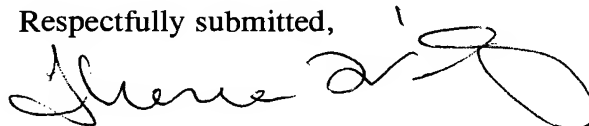
12. The Applicants hereby continue and maintain their traversal of these rejections and respectfully request reconsideration of this ground of rejection in light of the remarks submitted in the Response to Office Action dated November 20, 2006 to each of the arguments submitted by the Examiner in paragraph 12.

13. The Applicants hereby continue and maintain their traversal of this rejection and respectfully request reconsideration of this ground of rejection in light of the remarks submitted in the Response to Office Action dated November 20, 2006.

Conclusion

14. Applicants submit this Reply to the Final Office Action mailed January 31, 2007 under 37 CFR 1.116, requesting favorable consideration. Applicants respectfully request that the device Claims 21-27 be reconsidered in light of the foregoing amendment and remarks, notwithstanding Applicants belief that the claims would have been allowable as originally filed. The Examiner is cordially invited to telephone the undersigned for any reason, which would advance the allowance of the pending claims.

Respectfully submitted,



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